Bioflocculation of green microalgae using activated sludge and potential for biogas production

Radovici, Maria; Wágner, Dorottya Sarolta; Angelidaki, Irini; Valverde Pérez, Borja; Plósz, Benedek G.

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Bioflocculation of green microalgal biomass using activated sludge and potential for biogas production

Maria Radovic, Dorotya Sarolta Wagner*, Irini Angelidaki, Borja Valverde-Pérez, Benedek Gy. PlösZ
Department of Environmental Engineering, Technical University of Denmark, Miljøvej 115, DK-2800, Kgs. Lyngby, Denmark
*e-mail: dosaw@env.dtu.dk

1. INTRODUCTION

New technologies are developed to recover wastewater resources and increase energy yields in form of biogas [1].
- Potential energy recovery using microalgae.
Available harvesting methods are costly and energy intensive [2].
- Assess the potential of energy recovery via biogas production from the harvested activated sludge-algal biomass.

Objectives:
- Developing cost-efficient way of harvesting microalgae via bioflocculation using activated sludge from a short-SRT EBPR system.
- Assess the potential of energy recovery via biogas production from the harvested activated sludge-algal biomass.

2. METHODS

1. Flocculation experiments
Microalgal biomass:
Mixed green microalgal culture cultivated on effluent wastewater:
Chlorella sorokiniana and Scenedesmus sp.
Activated sludge:
Taken from a short SRT (3.5 d) EBPR system [3]:
- Solid-liquid separation after the aerobic phase (AS_A)
- Solid-liquid separation after the anaerobic phase (AS_AN)

Flocculation strategies:
Strategy I: Flocculation of microalgae and activated sludge
Strategy II: Step 1: Coagulation of microalgae with a cationic polymer (PDADMAC)
Step 2: Flocculation with activated sludge

2. Biomethane potential tests
Mesophilic conditions (37 ºC)
Digestion scenarios:
I. Algae
II. Algae + polymer (20 mg/g algae)
III. AS_A (activated sludge removed after the aerobic and after the anaerobic phase)
IV. AS_AN (activated sludge removed after the aerobic and after the anaerobic phase)
V. AS_AN (activated sludge removed after the aerobic and after the anaerobic phase)

4. Biogas potential and energy recovery

1. Biogas potential of biomass
2. Energy recovery

5. CONCLUSIONS

- An effective solution is proposed to harvest microalgal biomass and to significantly decrease the amount of polymer coagulant required;
- 97% microalgal biomass recovery was reached with 16 mg polymer/g algae;
- Poor settling sludge did not affect microalgal biomass recovery, however, due to bulking the biomass volume was increased;
- Optimum polymer dosing depends on the mixing ratio of algae and activated sludge;
- Co-digestion with biomass taken after the anaerobic phase enhanced biogas potential;
- Up to 40% of the influent COD of the EBPR was recovered as methane;
- Most of the COD was assimilated into biomass or mineralized to CO2, and only up to 10% is lost in the effluent of the EBPR.

ACKNOWLEDGEMENTS

The research was financially supported by the European Commission (E4WATER Project, FP7-NMP-2011-3-1 grant agreement 280756) and the Integrated Water Technology (InWATech) project (http://www.inwatech.org).www.iwahq.org

References: